EC3-33x
User Manual

Rev. 4 - 14.01.2003

The EC3-33x coldroom controller is a universal controller for refrigeration applications with an electronic stepper motor expansion valve like the EX5. The controller has six temperature inputs for coil in, coil out, air in, air out and defrost termination temperatures. The sixes temperature input is a universal temperature input. For measurement of the saturation pressure a PT3 pressure sensor with 4 – 20 mA interface can be connected to the controller. The controller has four relay outputs, one defined for compressor control, one defined for defrost heater control, one defined for an alarm output and one as a universal relay output. The TRIAC outputs is defined for fan control. The TRIAC can drive 24V / 230V 4A. The controller has four digital inputs for 24V AC/ DC or 230V AC. One input is defined for compressor failure, one input is defined for a door contact and two inputs are free for universal purpose. The stepper motor interface can drive stepper motor with 24V DC and 0.7 A. The optional display can show values with a decimal point in the range between -19.9 and +19.9°C otherwise without decimal point. An IR receiver for the optional IR remote control unit is build in. For communication purposes, an Echelon LONWorks interface is installed. Two transceiver types are available RS485 or FTT10A. The supply voltage is 24 VAC. Transformers for 230V or 110V mains supply are available as options.

DISPLAY ECD-001:

The data to be shown on the display can be selected by the user. In case of on alarm, the alarm code is displayed alternately with the selected data. The alarm code can be inhibited by the user. To scroll through all possible displayable data press the SEL button. The display will show for one second the numerical identifier of the data and then the selected data. After two minutes the display will return to the by /1 selected data.

NEURON ID / SERVICE BUTTON:

- Display :
  Press the ▲ button for app. 1 second to send the Neuron ID. An LED in the left upper corner will indicate the transmission of the Neuron ID.
  Controller:
  There is a small hole left of the network connector. Use a small pen or screwdriver to press the switch behind the hole. An LED close to the switch will light to indicate the transmission of the Neuron ID.

LOAD DEFAULT PARAMETERS:

- Use a small pen or screwdriver to press the service pin switch on the controller and switch on the power supply on. The EC3-21x will be reset to default parameters.

PARAMETERS:

The configuration parameters are protected by a numerical password. The default password is “12”. To select the parameter configuration :

- Press the PRG button for more than 5 seconds
- A flashing 0 is displayed
- Press ▲ or ▼ until 12 is displayed; (password)
- Press SEL to confirm password
- The first modifiable parameter code is displayed (/1).
- To modify parameters see Parameters modification below.

PARAMETER MODIFICATION:

- Press ▲ or ▼ to show the code of the parameter that has to be changed;
- Press SEL to display the selected parameter value;
- Press ▲ or ▼ to increase or decrease the value;
- Press SEL to temporally confirm the new value and display its code;
  Repeat the procedure from the beginning "*press ▲ or ▼to show...*"

To exit modifying the parameters with the new values:

- Press PRG to confirm the new values and exit the parameters modification procedure.

To exit without modifying any parameter:

- Do not press any button for at least 60 seconds (TIME OUT).
- Press “ESC” on IR remote control.

DEFROST ACTIVATION:

A defrost cycle can be activated locally from the keypad :

- Press the ▼ button for more than 5 seconds
- A flashing 0 is displayed
- Press ▲ or ▼ until 12 is displayed; (password)
- Press SEL to confirm password
- The defrost cycle is activated

CLEAR ALARMS:

A defrost termination or fan activation alarm can be cleared from the keypad :

- Press ▲ or ▼ for more than 5 seconds.
- “CL” will be shown in the display to indicate that the alarms are cleared.

INDICATIONS ON THE DISPLAY :

COMPRESSOR	Logical status of the compressor relay
FAN	Logical status of the fan relay
DEFROST	Logical status of the defrost heater relay
ALARM	Alarm condition

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LIST OF PARAMETERS

	Parameter	Values			
/	**DISPLAY PARAMETERS**	**Min**	**Max**	**Unit**	**Def**
/1	Value to be shown on display	0	11	-	0
/2	No alarms	0	1	flag	0
/5	Temperature unit	0	1	flag	0
/6	Decimal point	0	1	flag	0
/7	Display during defrost	0	2	flag	0
/C	Temperature alignment for /1 = 0	-20.0	+20.0	K	0.0

A	**ALARM PARAMETERS**	**Min**	**Max**	**Unit**	**Def**
A0	Mean factor alarm temperature	0	100	%	100
A1	Low temperature alarm delay	0	180	min	5
A2	High temperature alarm delay	0	180	min	5
A3	High temperature alarm delay after defrost	0	180	min	10
Ad	Door alarm delay	0	180	min	2
AH	High temperature alarm threshold	AL	70	°C/K	40
AL	Low temperature alarm threshold	-50	AH	°C/K	-40
At	Type of alarm threshold values 0 = absolute temperatures °C 1 = relative temperatures K to setpoint	0	1	flag	0

r	**THERMOSTAT PARAMETERS**	**Min**	**Max**	**Unit**	**Def**
r0	Door contact function	0	15	flag	6
r1	Min set-point value	-40	r2	°C	-40
r2	Max set-point value	r1	60	°C	40
r3	Day / night control 0 = off 1 = on	0	1	flag	1
r4	Thermostat mode	0	4	-	1
r6	Set-point night operation	r1	r2	°C	4.0
r7	Difference night operation	0.1	20.0	K	2.0
r8	Mean factor day operation	0	100	%	100
r9	Mean factor night operation	0	100	%	50
rd	Difference day operation	0.1	20.0	K	2.0
St	Set-point day operation	r1	r2	°C	2.0

d	**DEFROST PARAMETERS**	**Min**	**Max**	**Unit**	**Def**
d0	Defrost mode	0	2	-	1
d1	Termination by time / temperature	0	3	-	0
d2	Defrost termination sensor	0	1	flag	1
d3	Pulsed defrost	0	1	flag	0
d4	Defrost at power up	0	1	flag	0
d5	Delay for power up defrost	0	180	min	0
d6	Pump down delay	0	180	sec	0
d7	Drain delay	0	180	min	2
d8	Injection delay	0	180	sec	0
d9	Demand defrost mode	0	2	-	0
dd	Pulsed defrost difference	1	20	K	2
dH	Pulsed defrost set-point	-40	dt	°C	5
dt	Defrost termination temperature	-40	90	°C	8
dP	Maximal defrost duration	0	180	min	30
dI	Defrost interval	0	192	h	8
dU	Start up delay by synchronization	0	180	min	30

	Parameter	Values			
F	**FAN PARAMETERS**	**Min**	**Max**	**Unit**	**Def**
F1	Fan start-up sequence after defrost	0	4	-	0
F2	Fan status during no cooling	0	2	-	0
F3	Fan status during defrost	0	1	flag	0
F4	Fan stop delay time by no cooling	0	30	min	0
F5	Fan status during cleaning	0	1	flag	0
Fd	Fan start delay time after defrost	0	30	min	0
Ft	Fan on temperature after defrost	-40	40	°C	0

c	**COMPRESSOR PARAMETERS**	**Min**	**Max**	**Unit**	**Def**
c0	Delay first start of compressor	0	15	min	0
c1	Cycle time of compressor	0	15	min	0
c2	Min. stop time of compressor	0	15	min	0
c3	Min. run time of compressor	0	15	min	0

u	**SUPERHEAT PARAMETERS**	**Min**	**Max**	**Unit**	**Def**
u0	Refrigerant	0	4	-	3
u1	Correction glide / pressure drop	-20.0	20.0	K	0.0
u2	MOP control	0	1	flag	0
u3	MOP temperature	-40	40	°C	0
u4	Control mode	0	2	-	1
u5	Superheat init set-point	u6	u7	K	6
u6	Superheat set-point min	3	u7	K	3
u7	Superheat set-point max	u6	20	K	15
u8	Saturation temperature	0	1	flag	1
uu	Start opening	50	100	%	100
ut	Valve type	0	3	-	0

H	**OTHER PARAMETERS**	**Min**	**Max**	**Unit**	**Def**
H2	Keyboard and IR remote control 0 = all disabled (Caution, access to controller only via LON networ possible) 1 = Keyboard enabled 2 = IR remote control enabled 3 = Keyboard and IR remote control enabled	0	3	-	3
H3	IR remote control access code	0	199	-	0
H5	Password	0	199	-	12

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Remarks

- **/1 Value to be shown on display**
  0 = Thermostat control temperature, Alignment factor /C will only work with this temperature display
  1 = Air in temperature
  2 = Air out temperature
  3 = Alarm temperature
  4 = Defrost termination temperature
  5 = Coil in temperature
  6 = Coil out temperature
  7 = Superheat
  8 = Valve opening
  9 = Defrost status
  10 = not used
  11 = not used

- **/2 No alarms**
  0 = alarms will be shown on display
  1 = alarms will not be shown on display

- **/5 Temperature unit for display**
  0 = °C
  1 = °F

- **/6 Display with decimal point**
  0 = yes, in the range from –19.9 to 19.9
  1 = no

- **/7 Display during defrost**
  0 = "df"
  1 = "df" + defrost termination temperature
  2 = "df" + control temperature

- **r0 Door contact function**
  Contact closed or nviDoor = ST_ON
  Value = Cooling + Alarm + Timer + Action

  Cooling 0 = cooling
  1 = no cooling

  Alarm 0 = temperature alarm on, door alarm
  2 = temperature alarm off, door alarm off

  Timer 0 = Timer not started
  4 = Timer started

  Action when timer expired
  0 = temperature alarm on, door alarm
  8 = temperature alarm on, door alarm, cooling restart if "Cooling = 1"

- **r4 Thermostat mode**
  0 = off, no thermostat function, continues cooling
  air in and air out sensor monitoring off, no temp. alarms generated
  1 = cooling, deadband control
  cut in = set-point + difference
  cut out = set-point
  2 = cooling, modulating thermostat
  cut in = set-point
  cut out = set-point – difference /2
  3 = heating, deadband control
  cut in = set-point – difference
  cut out = set-point
  4 = on, external control by nviValve
  air in and air out sensor monitoring off, temp. alarms will be generated

- **A0 Mean factor alarm temperature**
- **r8 Mean factor day operation**
- **r9 Mean factor night operation**
  Temperature calculation by the following formula

  $$Temperature = Air_{in} - \left((Air_{in} - Air_{out}) * MeanFactor / 100 \right)$$

  Mean factor = 0 , Temperature = Air in
  Mean factor = 100, Temperature = Air out

- **d0 Defrost mode**
  0 = natural defrost, defrost heater not activated
  pulsed defrost not possible, synchronization by bindings
  1 = forced defrost, defrost heater activated, pulsed defrost possible, synchronization by bindings
  2 = forced defrost, defrost heater activated, pulsed defrost possible, synchronization by nviStartUp

- **d1 Termination by temperature / time**
  0 = termination by temperature, termination by time will generate an alarm
  1 = termination by time, termination by temperature will generate an alarm
  2 = first, what ever comes first time or temperature, no alarm
  3 = last, by time and temperature, no alarm

- **d2 Defrost termination sensor**
  0 = defrost termination sensor
  1 = air out sensor

- **d3 Pulsed defrost**
  0 = off, no pulsed defrost, heaters switched off at defrost termination temperature dt or max. time dP whatever is selected
  1 = on, pulsed defrost, dd and dH in use, heaters are switched off at dH and switched on again at dH – dd

- **d6 Pump down delay**
  The compressor will run during pump down delay while the valve is closed

- **d8 Injection delay**
  The valve is open during injection delay while the compressor is not running

- **d9 Demand defrost mode**
  0 = demand defrost off
  1 = on
  2 = on + defrost if no demand defrost within dI

- **F1 Start up sequence after defrost**
  0 = on
  1 = delayed by time Fd, error on temperature
  2 = by temperature Ft, error on time
  3 = first, whatever comes first time or temperature, no alarm
  4= last, time and temperature must come, no alarm

- **F2 Fan status during no cooling**
  0 = on
  1 = off
  2 = delayed by F4

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- **F3 Fan status during defrost**
  0 = on
  1 = off

- **F5 Fans status during cleaning**
  0 = off
  1 = on

- **u0 Refrigerant**
  0 = R22
  1 = R134a
  2 = R507
  3 = R404A
  4 = R407C

- **u1 Correction**
  Glide = positive Values
  Pressure drop = negative Values

- **u2 MOP Control**
  0 = off
  1 = on

- **u4 Control Mode**
  0 = off
  1 = fixed superheat
  2 = adaptive superheat

- **u8 Saturation Temperature**
  0 = Coil in temperature
  1 = Pressure

- **ut Valve type**
  0 = EX5
  1 = EX6
  2 = EX7
  3 = EX8

Note: Concerning the indicated parameters, it is recommended to check, before installing, if the factory value is suitable for the required use

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ALARMS AND MESSAGES

ALARM CODES

E0 **Coil in sensor failure**
E1 **Coil out sensor failure**
E2 **Air in sensor failure**
E3 **Air out sensor failure**
E4 **Defrost termination sensor failure**
E5 **Temp. 6 sensor failure**
E6 **Pressure sensor failure**

- No sensor connected.
- The sensor cable is broken or short circuited.

Er **Data error**

- Data send to the display is out of range.

Ad **Door open alarm**

AH **High temperature alarm**

AL **Low temperature alarm**

AE **Thermostat emergency operation**

- Air in and air out sensor failure

AF **Superheat, external system failure**

- External failure input is active

Ao **Superheat, emergency operation**

- Sensor failure

Ar **Superheat, no refrigerant flow**

- No refrigerant flow was detected

Au **Superheat, Valve opening 100%**

- Valve at 100 % opening for more then 2 minutes

dt **Defrost termination failure by time or temperature**

Ft **Fan start-up failure by time or temperature**

Ab **external battery alarm**

- external battery indicates an alarm

MESSAGES

--- **No data**

- The display will show an "---" at node start up and when no data is send to the display.

In **Configuration data initialization**

- The display will show an "In" when the configuration data are initialized with the factory default values.

Id **Wink request received**

- The display will show a flashing "Id" when the wink request was received. The flashing "Id" will be shown on the display until the service button will be pressed, or a 30 min delay timer will expire or a second wink request will be received by the node.

OF **Offline**

- The node is offline, no application is running. This is the result of a network management command an will happen for example during node installation.

oF **Digital input status**
on **Digital input status**

- Indication of the digital inputs, of = switch open, on = switch closed

dS **Defrost standby**

dP **Defrost pump down**

df **Defrost cycle**

dd **Defrost drain delay**

dI **Defrost injection delay**

du **Defrost start up delay**

Cn **Cleaning**

CL **Alarms are cleared**

N.B. When cleaning the display use damp cloth and neutral detergent.

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TECHNICAL SPECIFICATIONS

Temperature ranges:

Sensor	-50 / +50°C	or -58/+122°F
Enclosure		
Operating	0 / +50°C	or 32 / +122°F
Storage	-10 / +70°C	or 14 / +158°F

Power supply:	24V AC, -15%, +10%
Consumption:	12 VA
Case:	
Controller:	Aluminum 255 x 100 x 65 mm
Display:	Auto extinguishing Plastic, 75 x 33 x 73 mm
Mounting:	
Controller;	DIN rail
Display:	Panel mounting
Connections:	Plug in connectors for cables of max. 1.5 mm^2, min. 0.5 mm^2 section
Display:	2½ digits
Indicators LED:	Compressor, Fan, Defrost heater, IR activated, ALARM , Neuron ID

Inputs:	Compressor failure, Door contact, Switch 1, Switch 2, oil in, oil out, Air in temp., Air out temp., Defrost termination temp., Temp. # 6
Switch	24V AC / DC or 230V AC
Sensor:	NTC (10K at 25°C)
Pressure Sensor:	PT3-07 4- 20 mA
Outputs:	Relays SPDT I_{max} = 8A res (2A), VAC max = 250V TRIAC I_{max} = 4A, VAC max = 250V Stepper motor I_{max} = 0.7A, VDC = 24V

Environmental pollution	non aggressive atmosphere
Protection class	IP65 (frontal protection with gasket)
Insulation	class II

Important: Keep controller and sensor lines separated from mains cable with at least 3 cm.

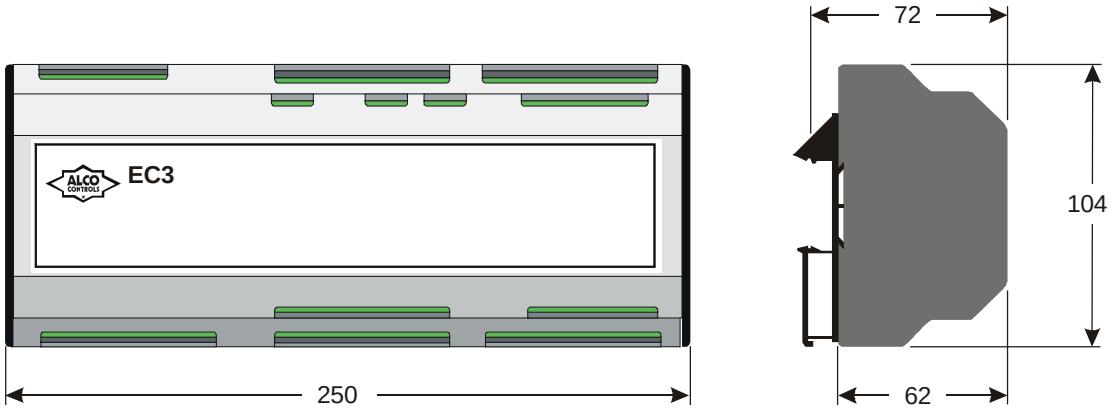
SAFETY STANDARD

In order to comply the safety standard (CEI 107-70) see the following:

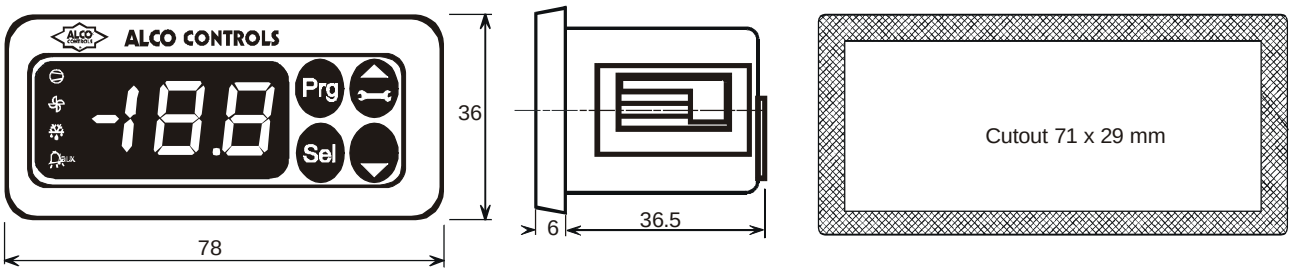
1) Connection cables should be suitable for 90°C operation;
2) Class II transformers 24 VAC double insulated must be used
3) Aluminum case must be connected to ground

DIMENSIONS

Housing Dimensions EC3-33x Controller



Housing Dimensions ECD-001 Display Unit



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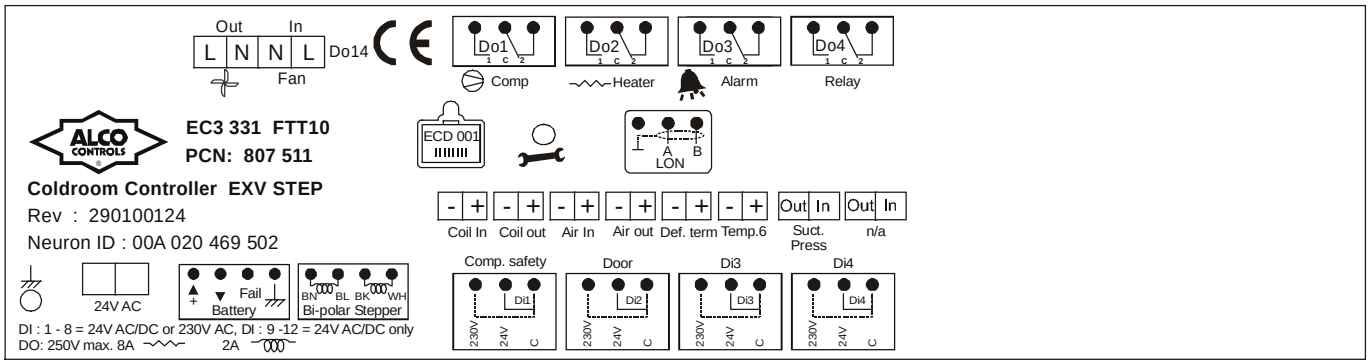
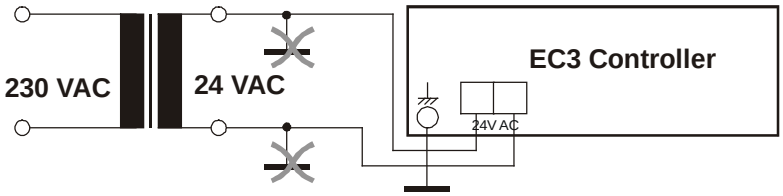
ELECTRICAL INSTALLATION

EC3-331 Wiring Diagram

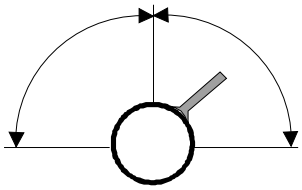




Warning: Use class II category transformer for 24 VAC power supply. Do not ground either of the 24 VAC lines! Failure to do so can result in internal power supply damage.
We recommend the use of separate transformers for 3rd party controllers, to avoid possible grounding problems in the power supply.

SENSOR POSITION

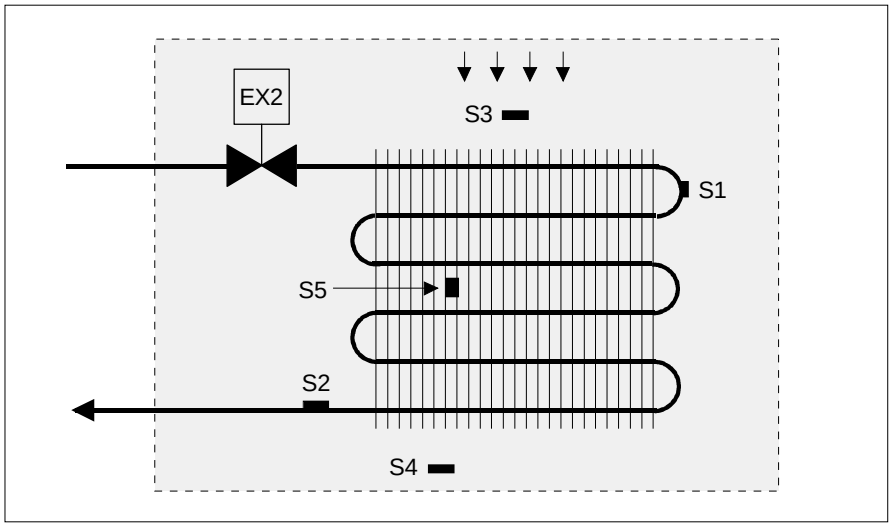
The pipe-sensors for measuring the coil inlet and outlet temperature must be fixed with metal clamps or temperature resistant plastic straps and it is recommended to insulate with ARMAFLEX™. The use of standard electrical plastic straps is not recommended because they cannot withstand the temperature changes and could become lose with time. This will then cause controller errors due to wrong temperature measurements.
The recommended position of the pipe sensors is between 9 and 3 o'clock as shown on the picture.



The air sensors must be mounted on spacers in the middle of the air duct so that the air flow around.

The recommended positions in detail :

1. S1 Coil inlet sensor : Position at the first return bend.
2. S2 Coil outlet sensor : Position direct after the evaporator on the common suction line.
3. S3 Air return sensor : In the air duct, in the middle of the cabinet, as high as possible.
4. S4 Air discharge sensor : In the air duct, as high as possible, asymmetric closer to the expansion valve.
5. S5 Fin sensor: On the evaporator, asymmetric closer to the expansion valve.



Caution : For low temperature cases with fans off during defrost, the uses of the fin sensor for defrost termination is highly recommended.

The sensor cables can be extended if necessary. The connections must be protected against water and dust.

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LonWorks Interface

RS 485

Structure	Bus
Termination	120 Ω at both ends
Medium	Twisted pair, 2-wires plus ground
Connection	11, 12 Data – 13 ground
Nodes / Segment	32 Units
Cable length	max. 1200 m depending on cable type
Transfer rate	39 kbits / s

FTT10

Structure	free topology
Termination	RC Network
Medium	Twisted pair, 2-wires
Connection	11, 12 Data - 13 free
Nodes / Segment	64 Units
Cable length	max. 2700 m depending on cable type and network structure
Transfer rate	78 kbits / s

Recommended cable types

Cable type	Ø / AWG	R Ω / km	C nF / km	V % of c	max. length in m
Belden 85102	1,3 mm / 16	28	56	62	2700
Belden 8471	1,3 mm / 16	28	72	55	2700
Level IV 22 AWG	0,65 / 22	106	49	67	1400
JY (ST) 2x2x0,8	0,8 / 20,4	73	98	41	900
TIA 568A CAT 5	0,51 / 24	168	46	58	900

For more details see the Echelon LonMark documentation

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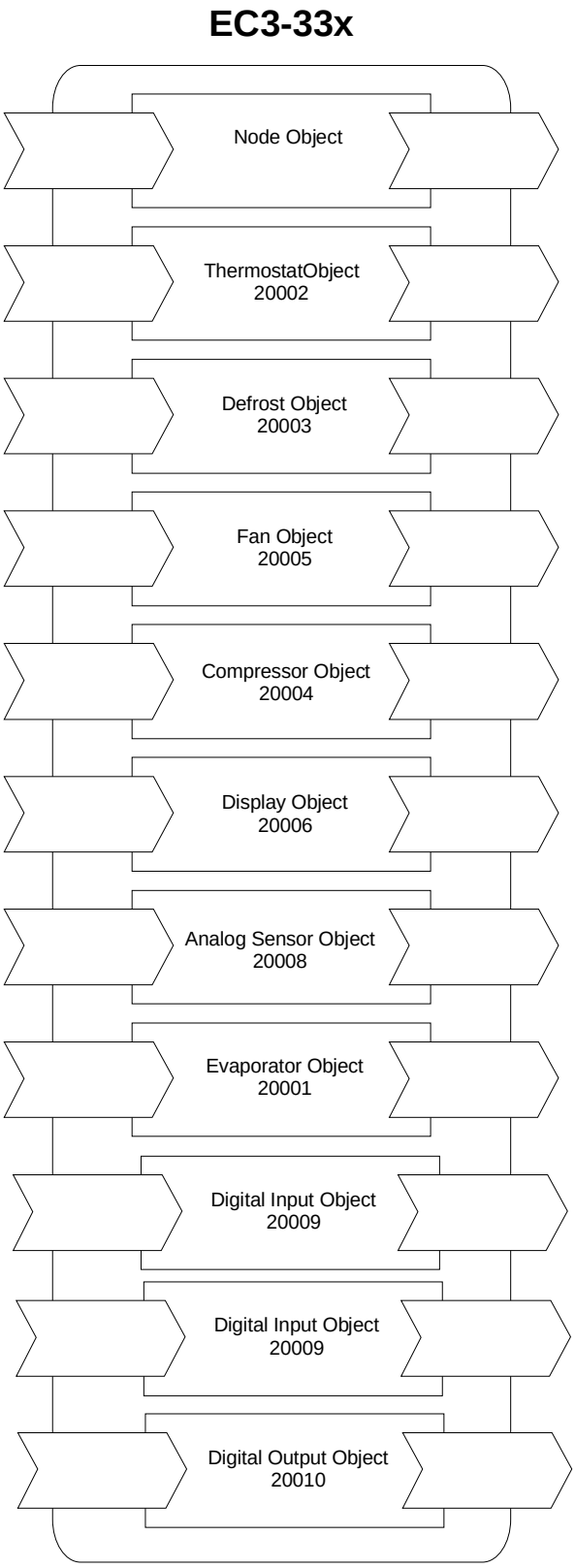
NODE OBJECTS

The EC3-33x coldroom controller has 11 LonMark Objects.



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NETWORK VARIABLES

Node Object

The node object includes all network variables which are necessary for the general communication with the node.

Network Variables

Variable Type	Name	Type	Meaning
SNVT_obj_request	nviRequest	I	Control and status request for one or all objects within the node
SNVT_obj_status	nvoStatus	O	Answer of a control or status request
SNVT_time_stamp	nviTimeSet	I	Set of internal software clock
SNVT_alarm	nvoAlarm	O	Alarm output for all objects within the node
SNVT_elapsed_tm	nciMaxSendT	C	Timer to send node and object status automatically
SNVT_elapsed_tm	nciMinSendT	C	Timer to delay network variable updates

The implemented control and status requests which can be accessed by “nviRequest” are :

- RQ_NORMAL
- RQ_DISABLED
- RQ_UPDATE_STATUS
- RQ_SELFTEST
- RQ_UPDATE_ALARM
- RQ_REPORT_MASK
- RQ_OVERRIDE
- RQ_ENABLE
- RQ_RMV_OVERRIDE
- RQ_CLEAR_STATUS
- RQ_CLEAR_ALARM
- RQ_ALARM_NOTIFY_ENABLED
- RQ_ALARM_NOTIFY_DISABLED
- RQ_MANUAL_CTRL
- RQ_REMOTE_CTRL
- RQ_PROGRAM

RQ_NORMAL - This requested object is set to normal operation. If the object was disabled, output network variable will be updated, the object will reacted on updates off input network variables. If the object was in override, the override mode will be switched off. An RQ_NORMAL request to the node object will bring all objects in the node to normal operation.

RQ_DISABLED - This requested object is disabled, output network variable of the object will not longer be updated. The object will not reacted on input network variable updates. The disable status is object dependent. An RQ_DISABLED request to the node object will bring all objects of the node in the disabled mode.

RQ_UPDATE_STATUS - The output network variable “nvoStatus” is updated with the current status of the requested object. An RQ_UPDATE_STATUS request to the node object will show in the network variable “nvoStatus” the logical or all status bits of all objects in the node.

RQ_SELFTEST – The behavior is object dependent.

RQ_UPDATE_ALARM – The network variable “nvoAlarm” is updated with the latest alarm message from the requested object.

RQ_REPORT_MASK - The output network variable “nvoStatus” is updated with the possible status bits of the requested object

RQ_OVERRIDE - The behavior is object dependent.

RQ_ENABLE - This requested object is set to normal operation. If the object was disabled, output network variable will be updated, the object will reacted on updates off input network variables. If the object was in override, the object will stay in override mode.

RQ_RMV_OVERRIDE - If the object was in override, the override mode will be switched off.

RQ_CLEAR_STATUS – The output network variable “nvoStatus” will be cleared.

RQ_CLEAR_ALARM – The behavior is object dependent.

RQ_ALARM_NOTIFY_ENABLED - The behavior is object dependent.

RQ_ ALARM_NOTIFY_DISABLED - The behavior is object dependent.

RQ_MANUAL_CTRL – The behavior is object dependent.

RQ_REMOTE_CTRL – The behavior is object dependent.

RQ_REMOTE_PROGRAM – The behavior is object dependent

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Thermostat Object

The thermostat object is responsible for the thermostat function. If the object is disabled the cooling/heating will be switched off and no network variable updates will be performed. Object status information is send by the nvoStatus variable of the node object. If the temperature alarm is disabled, the corresponding bit ("alarm_notify_disabled") in the status structure will be set. If the thermostat is in alarm, the corresponding bit ("in_alarm") and additional bits like "out of limits" for high or low temperature failure, "open circuit" for open door failure, "over range" for high temperature failure, "under range" for low temperature failure or "unable to measure" for emergency cooling, sensor failure on both temperature sensors will be set.

Network Variables

Variable Type	Name	Type	Meaning
SNVT_temp_p	nvoAirTemp	O	Control temperature used by thermostat object
SNVT_state	nvoThermostState	O	Thermostat object status
SNVT_lev_disc	nviDayNight	I	Day / night control, ST_OFF = day operation, ST_ON = night operation
SNVT_temp_p	nvoCutoutTemp	O	Cut out temperature used by thermostat object
SNVT_temp_p	nvoCutinTemp	O	Cut in temperature used by thermostat object
SNVT_temp_p	nvoAlarmAirTemp	O	Alarm temperature used by thermostat object
SNVT_temp_p	nvoAirOutTemp	O	Air out sensor temperature
SNVT_temp_p	nvoAirInTemp	O	Air in sensor temperature
SNVT_lev_disc	nvoValve	O	Status of the valve
SNVT_lev_disc	nviCleaning	I	Cleaning control, logical ored with switch input ST_OFF = cleaning off, ST_ON = cleaning on
SNVT_lev_disc	nviValve	I	Valve input for external control, ST_OFF = valve closed, ST_ON = valve open
SNVT_count	nvoCycleRate	O	Number of cut in / cut out cycles during last hour
SNVT_lev_disc	nviDoor	I	Door open input, ST_OFF = door closed, ST_ON = door open
SNVT_lev_disc	nviContRun	I	Continuos operation input, ST_OFF = normal operation, ST_ON = thermostat inhibit, continuos cooling
UNVT_THERMOSTAT	nciThermCnfg	C	Thermostat object configuration structure

The network variable from type SNVT_temp_p will have an value of 0x7FFF in case of an sensor failure or if no data was read from the sensor input.

The network variable "nvoThermostState" is an bit field and will represent the current status on the thermostat object.

Bit No.	Description
0	0 = thermostat off, 1= thermostat on
1	0 = no cooling, 1 = cooling
2	0 = no modulating thermostat, 1 = modulating thermostat
3	0 = day operation, 1 = night operation
4	0 = alarms active, 1 = alarms inhibit
5	
6	1 = High temperature alarm
7	1 = Low temperature alarm
8	1 = Door open alarm
9	0 = normal cooling, 1 = emergency cooling
10	0 = no cleaning, 1 = cleaning
11	0 = door closed, 1 = door open
12	0 = no defrost, 1 = defrost
13	0 = no operation change request, 1 = operation change request
14	1 = continues operation

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Configuration Parameters

Thermostat		UNVT_THERMOSTAT											
	Code	Description	Variable type	Name	Unit	Min	Max	Default	Res.	IR	Kb	Lon	
0	A0	Mean alarm factor	unsigned short	MeanAlarm	%	0	100	100		y	y	y	*1
1	A1	Low limit delay	unsigned short	LowAlarmDelay	min	0	180	5		y	y	y	Low limit temperature alarm delay
2	A2	High limit delay	unsigned short	HighAlarmDelay	min	0	180	5		y	y	y	High lim
3	A3	High limit defrost delay	unsigned short	DefAlarmDelay	min	0	180	10		y	y	y	High limit temperature alarm delay for defrost
4	Ad	Door alarm delay	unsigned short	DoorAlarmDelay	min	0	180	2		y	y	y	Alarm delay for door contact and restart time for cooli
5	AH	High limit temperature	signed short	HighLimTemp	°C	AL	70	40		y	y	y	High temperature limit
6	AL	Low limit temperature	signed short	LowLimTemp	°C	-50	AH	-40		y	y	y	Low temperature limit
7	At	Type of alarm limits	unsigned short	AlarmLimit		0	1	0		y	y	y	*7
8	r0	Door contact function	unsigned short	DoorContact		0	15	6		y	y	y	*2
9	r1	Min setpoint value	signed short	MinSetPoint	°C	-40	r2	-40		y	y	y	Min cut out threshold
10	r2	Max setpoint value	signed short	MaxSetPoint	°C	r1	60	40		y	y	y	Max cut out threshold
11	r3	Day night control	unsigned short	DayNightCtrl		0	1	1		y	y	y	0 = off, 1 = on
12	r4	Thermostat mode	unsigned short	ThermMode		0	4	1		y	y	y	*3
13	r6	Setpoint night operation	signed long	SpNight	°C	r1	r2	4	0.1	y	y	y	Setpoint for night operation, controled by nv and r3
14	r7	Difference night operation	unsigned short	DiffNight	K	0.1	20	2	0.1	y	y	y	Difference for deadband calculation
15	r8	Mean factor day operation	unsigned short	MeanDay	%	0	100	100		y	y	y	*4
16	r9	Mean factor night operation	unsigned short	MeanNight	%	0	100	50		y	y	y	*5
17	rd	Difference day operation	unsigned short	DiffDay	K	0.1	20	2	0.1	y	y	y	Diff. between cut in & cut out
18	St	Setpoint day operation	signed long	SpDay	°C	r1	r2	2	0.1	y	y	y	Setpoint for day operation, controled by nviDayNight a
19		Sensor selection	unsigned short	Sensor		0	3	0		n	n	y	*6
Total 22 bytes													
*1	Calculation : nvoAlarmAirTemp = ReturnTemp -(ReturnTemp - DischargeTemp)*MeanAlarm/100												
*2	DoorContact = Cooling + Alarm + Timer + Action												
		Cooling	0 = cooling when door open										
			1 = no cooling when door open										
		Alarm	0 = alarm on when door open										
			2 = alarm off when door open										
		Timer	0 = Timer not startet when door open										
			4 = Timer startet when door open										
		Action	0 = alarm activated when timer over										
			8 = alarm activated and cooling restartet when timer over										
*3	0 = off												
	1 = cooling, DB thermostat												
	2 = cooling, Mod. Thermostat												
	3 = heating, DB thermostat												
	4 = external control, controller follows nviValve												
*4	Calculation : nvoAirTemp = ReturnTemp -(ReturnTemp - DischargeTemp)*MeanDay/100												
*5	Calculation : nvoAirTemp = ReturnTemp -(ReturnTemp - DischargeTemp)*MeanNight/100												
*6	0 = Sensors internal												
	1 = Discharge air temperature sensor from LON network												
	2 = Return air temperature sensor from LON network												
	3 = both air sensors from LON network												
*7	0 = Alarm limits absolute												
	1 = Alarm limits relative to set point												

Alarm Messages

Alarm messages will be send by the “nvoAlarm” of the node object.

Condition	SNVT #	Alarm Value	Message	Priority
Low temperature alarm occurs	105	nvoAlarmAirTemp	AL_LOW_LMT_ALM_1	PR_LEVEL_3
Low temperature alarm disappears	105	nvoAlarmAirTemp	AL_LOW_LMT_CLR_1	PR_LEVEL_0
High temperature alarm occurs	105	nvoAlarmAirTemp	AL_HIGH_LMT_ALM_1	PR_LEVEL_3
High temperature alarm disappears	105	nvoAlarmAirTemp	AL_HIGH_LMT_CLR_1	PR_LEVEL_0
Emergency alarm condition occurs	105	nvoAirTemp	AL_ALM_CONDITION	PR_LEVEL_3
Emergency alarm condition disappears	105	nvoAirTemp	AL_NO_CONDITION	PR_LEVEL_0
Door open alarm condition occurs	22	nviDoor	AL_ALM_CONDITION	PR_LEVEL_3
Door open alarm condition disappears	22	nviDoor	AL_NO_CONDITION	PR_LEVEL_0

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Defrost Object

The defrost object is responsible for the defrost function. If the object is disabled it will change to “defrost standby”, any running defrost will be terminated, no further defrost will happen. No network variable updates will be performed, the object will not react on any input network variable update. Object status information is send by the nvoStatus variable of the node object. If the object has a defrost termination alarm, the alarm bit (“in_alarm”) of the status structure will be set.

Network Variables

Variable Type	Name	Type	Meaning
SNVT_lev_disc	nviDefrostEnable	I	External start signal to activate a defrost. The ST_OFF to ST_ON transition will start the defrost. If the variable change to ST_OFF while the object is in the defrost cycle, the defrost will be terminated and the end of defrost cycle starts
SNVT_defr_state	nvoDefrostState	O	Defrost object status
SNVT_temp_p	nvoDefrTemp	O	Currently used defrost termination temperature
SNVT_lev_disc	nvoHeater	O	Status of the defrost heater
SNVT_lev_disc	nviStartUp	I	Input to terminate a synchronized defrost, ST_ON will start end of defrost cycle
SNVT_lev_disc	nviDefrLock	I	Defrost lock, if ST_ON no defrosts are possible, any running defrost will be terminated
SNVT_lev_disc	nvoDefrCtrlSync	O	used for synchronized defrost by bindings
SNVT_lev_disc	nviDefrCtrlSync	I	used for synchronized defrost by bindings
UNVT_DEFSYNC	nvoDefrEndSync	O	used for synchronized defrost by bindings
UNVT_DEFSYNC	nviDefrEndSync	I	used for synchronized defrost by bindings
SNVT_elapsed_tm	nvoDefrostTime	O	Defrost duration
SNVT_state	nvoDefrStatus	O	Detailed status of the defrost object
UNVT_DEFROST	nciDefrostCnfg	C	Defrost object configuration structure

The network variable from type SNVT_temp_p will have an value of 0x7FFF in case of an sensor failure or if no data was read from the sensor input.

The network variable “nvoDefrStatus” is a bit field and will represent the current status on the defrost object.

Bit No.	Description
0	0 = no Defrost cycle , 1 = Defrost cycle
1	0 = Heater off , 1 = Heater on
2	0 = Pulsed heater off , 1 = Pulsed heater on
3	0 = Demand defrost off, 1 = demand defrost on
4	
5	
6	
7	
8	0 = no termination alarm, 1 = termination alarm

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Configuration Parameters

Alarm Messages

Alarm messages will be send by the “nvoAlarm” of the node object.

Condition	SNVT #	Alarm Value	Message	Priority
Defrost termination alarm occurs	83	IntAlarm	AL_ALM_CONDITION	PR_LEVEL_0
Defrost termination alarm disappears	83	IntAlarm	AL_NO_CONDITION	PR_LEVEL_0

```
SNVT_state      IntAlarm;     // Internal alarm status
                              // Bit0  1 = Termination by time
                              // Bit1  1 = Termination by temperature
                              // Bit2  1 = Synchronized defrost terminated by time
```


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Fan Object

The fan object controls the behavior of the fan. If the object is disabled the fan will be turned off , no network variable updates will be performed and the object will no react on any input nv update.. The status information is send by the nvoStatus of the node object. If a failure is detected, the “in_alarm” bit in the status structure will be set, if the fan is in manual control, the “manual control” bit is set..

Network Variables

Variable Type	Name	Type	Meaning
SNVT_lev_disc	nvoFanState	O	Status of the fan
SNVT_switch	nviForcedFan	I	Manual control of fan, state = 1 to activate manual control, value = 0 fan off, value =1 fan on
SNVT_state	nvoFanStatus	O	Status of the fan object
UNVT_FAN	nciFanCnfg	C	Configuration parameters of the fan object

The network variable “nvoFanStatus” will represent the status of the fan object.

Bit No.	Description
0	Fan off / on
1	Off / on function delayed
2	Manual control
8	1 = Termination error

Configuration Parameters

Fan		UNVT_FAN												
	Code													
		Description	Variable type	Name	Unit	Min	Max	Default	Res.	IR	Kb	Lon		
0	F1	Fan startup sequence after defrost	unsigned short	StartUp		0	4	0		y	y	y		*1
1	F2	Fan status by thermostat off	unsigned short	FanThermOff		0	2	0		y	y	y		*2
2	F3	Fan state during defrost	unsigned short	FanDefr		0	1	0		y	y	y		*3
3	F4	Fan stop delay time by thermostat off	unsigned short	OffDelay	min	0	30	0		y	y	y		
4	F5	Fan state during cleaning	unsigned short	FanCleaning		0	1	0		y	y	y		*4
5	Fd	Fan start delay time after defrost	unsigned short	StartUpDelay	min	0	30	0		y	y	y		
6	Ft	Fan on temperature after defrost	signed short	StartUpTemp	°C	-40	40	0		y	y	y		
7		Fan temperature sensor	unsigned short	Sensor		0	1	0		n	n	y		*5
Total 8 bytes														
	*1	0 = on, 1 = time, 2 = temp, 3 = first, 4 = last												
	*2	0 = on, 1 = off, 2 = delayed by F4												
	*3	0 = on, 1 = off												
	*4	0 = off, 1 = on												
	*5	0 = Sensor internal												
		1 = Sensor from LON network												

Alarm Messages

Alarm messages will be send by the “nvoAlarm” of the node object.

Condition	SNVT #	Alarm Value	Message	Priority
Termination failure occurs	83	IntAlarm	AL_ALM_CONDITION	PR_LEVEL_0
Termination failure disappears	83	IntAlarm	AL_NO_CONDITION	PR_LEVEL_0

```
SNVT_state      IntAlarm;    // Internal alarm status
                             // Bit0 = 1  Terminated by time
                             // Bit1 = 1  Terminated by temperature
                             // Bit1 = 1  Terminated by temperature
```


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Compressor Object

The compressor object controls the behavior of the compressor. If the object is disabled the compressor will be turned off , no network variable updates will be performed and the object will no react on any input nv update.. The status information is send by the nvoStatus of the node object. If a failure is detected, the “in_alarm” bit in the status structure will be set, if the compressor is in manual control, the “manual control” bit is set..

Network Variables

Variable Type	Name	Type	Meaning
SNVT_lev_disc	nvoCompState	O	Status of the compressor
SNVT_switch	nviForcedComp	I	Manual control of Compressor, state = 1 to activate manual control, value = 0 compressor off, value =1 compressor on
SNVT_state	nvoCompStatus	O	Status of the compressor object
SNVT_lev_disc	nviCompSafety		Failure input for compressor safety, ST_ON = compressor off and locked
UNVT_COMP	nciCompCnfg	C	Configuration parameters of the fan object

The network variable “nvoCompStatus” will represent the status of the compressor object.

Bit No.	Description
0	Compressor off / on
1	Off function inhibit
2	On function inhibit
3	Pump down delay
4	Manual control
5	External failure

Configuration Parameters

Compressor (Single stage compressor control)				UNVT_COMP									
	Code	Description	SNVT	Name	Var. type	Unit	Min	Max	Default	Res.	IR	Kb	Lon
0	c0	Delay for first start of compressor	unsigned short	DlyFirstStart	C	min	0	15	0		y	y	y
1	c1	Time between two compressor starts	unsigned short	CompCycle	C	min	0	15	0		y	y	y
2	c2	Minimum stop time of compressor	unsigned short	CompStop	C	min	0	15	0		y	y	y
3	c3	Minimum run time of compressor	unsigned short	CompRun	C	min	0	15	0		y	y	y
Total 4 bytes													

Alarm Messages

Alarm messages will be send by the “nvoAlarm” of the node object.

Condition	SNVT #	Alarm Value	Message	Priority
External failure occurs	22	nviCompSafety	AL_ALM_CONDITION	PR_LEVEL_3
External failure disappears	22	nviCompSafety	AL_NO_CONDITION	PR_LEVEL_3

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Display Object

The display object controls the display and the presentation of data. If the object is disabled no data will be shown on the display and no network variable update will be performed. If the object is in override, the display will show special messages like wink message or offline status of node.

Network Variables

Variable Type	Name	Type	Meaning
SNVT_lev_disc	nvoAlarmState	O	ST_ON if alarm, else ST_OFF
UNVT_DISPLAY	nciDispCnfg	C	Configuration parameters

Configuration Parameters

Display		UNVT_DISPLAY												
	Code	Description	Variable type	Name	Unit	Min	Max	Default	Res.	IR	Kb	Lon	
0	H2	Enable IR and keypad	unsigned short	IrKb		0	3	3		y	y	y	*1
1	H3	IR access code	unsigned short	IRCode		0	199	0		y	y	y	
2	H5	Password	unsigned short	PassWord		0	199	12		y	y	y	
3	/1	Value to be shown	unsigned short	Data		0	11	0		y	y	y	*2
4	/2	Display no alarms	unsigned short	NoAlarms		0	1	0		y	y	y	*3
5	/5	Temperature unit for display	unsigned short	TempUnit		0	1	0		y	y	y	*4
6	/6	Temperature display with decimal point	unsigned short	TempPoint		0	1	0		y	y	y	*5
7	/7	Display during defrost	unsigned short	Defrost		0	2	0		y	y	y	*6
8	/C	Alignment number for temp. display	signed long	Alignment	K	-20	20	0	0.1	y	y	y	
Total 10 bytes													
	*1	0 = Keyboard and IR disabled											
		1 = only keyboard enabled											
		2 = only IR enabled											
		3 = Keyboard and IR enabled											
	*2	0 = Control Temp											
		1 = Sensor 1											
		2 = Sensor 2											
		3 = Sensor 3											
		4 = Sensor 4											
		5 = Sensor 5											
		6 = Sensor 6											
		7 = Superheat											
		8 = Valve Opening											
		9 = Defrost Status											
		10 = Digital input #1											
		11 = Digital input #2											
	*3	0 = off, 1 = on											
	*4	0 = °C, 1 = °F											
	*5	0 = decimal point, 1 = no decimal point											
	*6	0 = "def", 1 = "def" + def. Temp, 2 = "def" + air temp											

Alarm Messages

The display object will not generate alarm messages

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Analog Sensor Object

The analog sensor object controls the analog inputs. If the object is disabled no data will be requested from the analog inputs and no network variable updates will be performed. The status information is send by the nvoStatus of the node object. If any sensor failure is detected, the “in_alarm” bit in the status structure is set.

Network Variables

Variable Type	Name	Type	Meaning
SNVT_state	nvoAnalogStatus	O	Bitfield to represent the error status of the analog inputs
SNVT_temp_p	nvoTemp6	O	Value of temperature sensor 6
UNVT_ANALOG	nciAnaCnfg	C	Configuration parameters of analog sensor object

The network variable “nvoAnalogStatus” will represent the error status on a sensor input when the failure monitoring is activated. The default setting is “**monitoring on**” for all control sensors and “**monitoring off**” for the temp. 6 sensor. For each sensor two bits are used from the bit field.

Bit Number	Meaning	Error code on display
0	Coil in sensor open	E0
1	Coil in sensor short circuit	E0
2	Coil out sensor open	E1
3	Coil out sensor short circuit	E1
4	Air in sensor open	E2
5	Air in sensor short circuit	E2
6	Air out sensor open	E3
7	Air out sensor short circuit	E3
8	Defrost termination sensor open	E4
9	Defrost termination sensor short circuit	E4
10	Temperature # 6 sensor open	E5
11	Temperature # 6 short circuit	E5
12	Pressure sensor open	E6
13	Pressure sensor short circuit	E6

Configuration Parameters

Analog Sensor			UNVT_ANALOG										
	Code	Description	SNVT	Name	Unit	Min	Max	Default	Res.	IR	Kb	Lon	
1	t1	Sensor 1 alarm monitoring	unsigned short : 1	Sensor 1		0	1	0		n	n	y	*1
2	t2	Sensor 2 alarm monitoring	unsigned short : 1	Sensor 2		0	1	0		n	n	y	
3	t3	Sensor 3 alarm monitoring	unsigned short : 1	Sensor 3		0	1	0		n	n	y	
4	t4	Sensor 4 alarm monitoring	unsigned short : 1	Sensor 4		0	1	0		n	n	y	
5	t5	Sensor 5 alarm monitoring	unsigned short : 1	Sensor 5		0	1	0		n	n	y	
6	t6	Sensor 6 alarm monitoring	unsigned short : 1	Sensor 6		0	1	0		n	n	y	
7	t7	Sensor 7 alarm monitoring	unsigned short : 1	Sensor 7		0	1	0		n	n	y	
8	t8	Sensor 8 alarm monitoring	unsigned short : 1	Sensor 8		0	1	0		n	n	y	
9	P1	Pressure sensor 1 type	unsigned short : 4	PressSensor1Type		0	2	0		n	n	y	*2
10	P2	Pressure sensor 2 type	unsigned short : 4	PressSensor2Type		0	2	0		n	n	y	*2
Total 2 bytes								Default values depending on version					
	*1	0 = Alarm monitoring on											
		1 = Alarm monitoring off											
	*2	0 = PT3-07A											
		1 = PT3-18A											
		2 = PT3-30A											

Alarm Messages

Alarm messages will be send by the “nvoAlarm” of the node object.

Condition	SNVT #	Alarm Value	Message	Priority
any sensor failure occurs	83	nvoAnalogStatus	AL_ALM_CONDITION	PR_LEVEL_3
any sensor failure disappears	83	nvoAnalogStatus	AL_NO_CONDITION	PR_LEVEL_0

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Superheat Object

The superheat object is responsible for the superheat function. If the object is disabled, the valve will be closed. No network variable updates will be performed, the object will not react on any input network variable update. Object status information is send by the nvoStatus variable of the node object. If the object has an alarm condition, the alarm bit “in_alarm” of the status structure plus the additional alarm bits like “unable to measure” for sensor failures, “out of limits” for 100% valve opening and “locked out” for external alarm condition will be set. If the object is in manual control, the “manual control” bit is set. If the superheat set-point should be overwritten by an external device, the “in override” request must be send to the object. These mode is indicated by the “in override” bit of the status structure.

Network Variables

Variable Type	Name	Type	Meaning
SNVT_lev_percent	nvoValveOpening	O	Current opening of the expansion valve
SNVT_evap_state	nvoEvapState	O	Current status of the superheat object
SNVT_temp_p	nvoEvapInTemp	O	Currently used coil in temperature of the superheat object
SNVT_temp_p	nvoEvapOutTemp	O	Currently used coil out temperature of the superheat object
SNVT_switch	nviForcedValve	I	Manual control of the valve output
SNVT_temp_p	nvoSuperheatRef	O	Currently used superheat set-point
SNVT_temp_p	nviSuperheatRef	I	External superheat set-point, only in use when object is in override
SNVT_temp_p	nvoDeltaTemp	O	Calculated superheat from coil out – coil in or coil out – saturation temperature calculated from saturation pressure
SNVT_press	nvoPressure	O	Saturation pressure output
SNVT_lev_disc	nviSystemFailure	I	Input to lock the controller, ST_ON = valve closed and controller locked
SNVT_state	nvoEvapStatus	O	Detailed object status
UNVT_EVAPORATOR	nciEvapCnfg	C	Superheat object configuration structure

The network variable from type SNVT_temp_p will have an value of 0x7FFF in case of an sensor failure or if no data was read from the sensor input.

The network variable “nvoEvapStatus” is a bit fields and will represent the current status of the superheat object.

Bit No.	Description
0	0 = Controller off, 1= Controller on
1	0 = no cooling, 1 = cooling
2	0 = no temperature modulating , 1 = temperature modulating
3	0 = fixed operation, 1 = adaptive operation
4	0 = automatic mode, 1= manual mode
5	0 = no MOT, 1 = MOT active
6	1 = Battery failure
7	1 = System failure
8	1 = Emergency operation
9	1 = no Refrigerant flow
10	1 = Evap. in sensor failure
11	1 = Evap. out sensor failure
12	1 = Pressure sensor failure
13	1 = Media sensor failure
14	1 = Air temp sensor failure
15	1 = 100% valve opening

Configuration Parameters

Superheat		UNVT_EVAPORATOR											
	Code	Description	Variable type	Name	Unit	Min	Max	Default	Res.	IR	Kb	Lon	
0	u0	Refrigerant	unsigned short	Refrig		0	4	3		y	y	y	*1
1	u1	Correction	signed long	Corr	K	-20	20	0	0.1	y	y	y	*2
2	u2	MOP Control	unsigned short	MOP		0	1	0		y	y	y	*3
3	u3	MOP temperature	signed short	MOPTemp	°C	-40	40	0		y	y	y	
4	u4	Control mode	unsigned short	Mode		0	2	1		y	y	y	*4
5	u5	Super heat reference init	unsigned short	RefInit	K	u6	u7	6		y	y	y	
6	u6	Super heat reference min	unsigned short	RefMin	K	3	u7	3		y	y	y	
7	u7	Super heat reference max	unsigned short	RefMax	K	u6	20	15		y	y	y	
8	u8	Saturation Temperatur	unsigned short	SatTemp		0	1	0		n	n	y	*5
9	uu	Start up opening	unsigned short	Opening	%	50	100	100		y	y	y	
10	ut	Valve type	unsigned short	ValveType		0	3	0		y	y	y	*7
11		Data source	unsigned short	Sensor		0	31	0		n	n	y	*6
Total 13 bytes													
*1	0 = R22												
	1 = R134a												
	2 = R507												
	3 = R404A												
	4 = R407C												
*2	Glide = + Values												
	Pressure drop = - Values												
*3	0 = Off												
	1 = On												
*4	0 = Off												
	1 = fixed superheat												
	2 = adaptive superheat												
*5	0 = Temperature												
	1 = Pressure												
*6	Sensor = EvapIn + EvapOut + AirTemp + MediaTemp + Pressure												
		EvapIn	0 = Internal										
			1 = LON network										
		EvapOut	0 = Internal										
			2 = LON network										
		AirTemp	0 = Internal										
			4 = LON network										
		MediaTemp	0 = Internal										
			8 = LON network										
		Pressure	0 = Internal										
			16 = LON network										
*7	Valve type (only stepper motor valves)												
	0 = EX5												
	1 = EX6												
	2 = EX7												
	3 = EX8												

Alarm Messages

Alarm messages will be send by the “nvoAlarm” of the node object.

Condition	SNVT #	Alarm Value	Message	Priority
Any internal alarm occurs	83	nvoEvapStatus	AL_ALM_CONDITION	PR_LEVEL_3
Any internal alarm disappears	83	nvoEvapStatus	AL_NO_CONDITION	PR_LEVEL_0
External alarm occurs	22	nviSystemFailure	AL_ALM_CONDITION	PR_LEVEL_3
External alarm disappears	22	nviSystemFailure	AL_NO_CONDITION	PR_LEVEL_0

Digital Input Object

The digital input object controls the switch inputs. If the object is disabled no network variable update will be performed.

Network Variables

Variable Type	Name	Type	Meaning
SNVT_lev_disc	nvoDI[]	O	Status of input switch, ST_ON = closed, ST_OFF = open

Configuration Parameters

The digital input object has no configuration properties.

Alarm Messages

The digital input object will not generate alarm message

Digital Output Object

The digital output object controls the relays and the TRIAC. If the object is disabled the object will not react on any network variable update and the digital outputs will stay unchanged.

Network Variables

Variable Type	Name	Type	Meaning
SNVT_lev_disc	nviDO[]	I	Logical status of relay or TRIAC
SNVT_lev_disc	nciInvert[]	C	Logic of the output, ST_OFF = positive logic, ST_ON = negative logic

Configuration Parameters

The configuration network variable “nciInvert[]” defines the logic for the output relays or the TRIAC.
If the value is ST_OFF the output is in positive logic. That means a ST_ON on the input will activate the relay/TRIAC.
If the value is ST_ON the output is in negative logic. That means a ST_OFF on the input will activate the relay/TRIAC.

Alarm Messages

The digital output object will not generate alarm message

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